

REMARKS/ARGUMENT

Claims 1-9, 20 and 23-24 have been canceled without prejudice. Claim 10 has been amended and claims 27-50 have been added by this amendment. Accordingly, claims 10-19, 21, 22 and 25-50 are pending in the present application. No new matter has been added.

In the final Office Action, claims 1-26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over JP(I) in view of Sliwa (U.S. Patent No. 4,990,462) and Sherry (U.S. Patent No. 4,763,829). Applicant respectfully traverses this rejection as applied to claim 10.

Among the limitations of independent claim 10 which are neither disclosed nor suggested in the prior art are:

“positioning said device electrode so as to contact said opposite surface of said solder bump such that the center of said device electrode is not aligned with the center of said substrate electrode while said device is at least partially submerged in said liquid;”
and

“aligning the center of said device electrode with the center of said substrate electrode by surface tension of said solder bump when said solder bump is melted and while said device is at least partially submerged in said liquid and at least partially supported by a buoyant force thereby joining said device electrode and said substrate electrode to each other”.

The JP(I) reference, of which an English language translation is enclosed, discloses a method of joining a semiconductor element to a substrate while placing them in a saturated vapor or a heated inactive solvent. As stated therein, JP(I) teaches that the semiconductor element 10 and substrate 13 are supported on an upper jig 14 and a lower jig 15 and pressurized against each other, and then “dipped” into the saturated vapor or inactive solvent for bonding together with eutectic solder 12. There is no mention that the center of the electrodes of the semiconductor element and the substrate are aligned with each other through the melting of the solder and the supporting of the semiconductor element by the buoyant force of the liquid. In fact, inasmuch as JP(I) teaches that the semiconductor element and substrate are forced together (pressurized) by

upper and lower jigs, respectively, it cannot operate to join a device and a substrate together as claimed and teaches away from the claimed method.

Sliwa does not remedy any of the deficiencies of the JP(I) reference. Sliwa is directed to a method for the co-planar integration of a plurality of semiconductor IC devices and is merely used to join a plurality of semiconductor devices into a pseudomonolithic substrate. As described in Sliwa, the plurality of IC segments 10 are mated together along their edges through the use of a floatation liquid 20. The floatation liquid 20 allows for the alignment of each of the IC segments 10 to form a co-planar pseudomonolithic substrate. See column 11, line 19 through column 12, line 36. Similar to JP(I), Sliwa does not teach or suggest that the center of the electrodes of a device and a substrate can be joined and aligned with each other in a liquid through the melting of solder and the supporting of the device by the buoyant force of the liquid as called for claim 10. Sliwa merely teaches that a floatation liquid is used to join a plurality of IC segments along a common plane.

Sherry adds nothing to the disclosure of the JP(I) reference and/or Sliwa. Sherry merely discloses the use of ultrasonic energy to break down the surface tension of the solder thereby permitting the solder to penetrate the openings in the mask and wet the exposed pads. There is no teaching or suggestion in Sherry that the center of the electrodes of a device and a substrate can be joined and aligned with each other in a liquid through the melting of solder and the supporting of the device by the buoyant force of the liquid as called for claim 10.

Given the above references and their teachings, neither the JP(I) reference, Sliwa and/or Sherry, either alone or combined, teach or suggest that the center of the electrodes of a device and a substrate can be joined and aligned with each other in a liquid through the melting of solder and the supporting of the device by the buoyant force of the liquid. These references simply do not describe such a method.

Accordingly, since the JP(I) reference, Sliwa and/or Sherry, either alone or combined, do not teach or suggest the limitations of independent claim 10 as described above, it is respectfully submitted that independent claim 10 patentably distinguishes over the art of record, and reconsideration and withdrawal of this rejection is respectfully requested.

Claims 11-19, 21-22 and 25-26 depend from claim 10 and include all of the limitations found therein. These claims recite additional limitations which, in combination with the limitations of claim 10 are neither disclosed nor suggested in the art of record and are likewise patentable for at least the same reasons discussed above with respect to independent claim 10.

Claims 27-50 have been added to more fully cover the scope of the present invention. Consideration and allowance of these claims is respectfully requested.

The prior art made of record and not relied upon has been carefully reviewed. It is believed that these references, either alone or combined with any other references of record, do not render the pending claims unpatentable.

In view of the foregoing, favorable consideration of the amendments to claim 10, favorable consideration of new claims 27-50, and allowance of the application with claims 10-19, 21, 22 and 25-50 is respectfully and earnestly solicited.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Asst. Commissioner for Patents, Washington, D.C. 20231, on June 6, 2001:

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Name of applicant, assignee or
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June 6, 2001

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Respectfully submitted,

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